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Systemic Cognition and Education

Empowering Students for Excellence in
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Preface

Making sense of our own selves and of the world around us has always been the prime concern of human beings, for the sake of survival, progress, and prosperity at the individual and collective levels, for curiosity's sake, and for various other purposes. All along, and at least since the dawn of civilizations and humans' invention of image drawing and carving on stone, hieroglyphs, and then alphabets, came the concern to systematize our quest for meaningful knowledge and its sustainability in memory, as well as its documentation and exchange with others in readily accessible forms and its deployment in efficient and creative ways.

Systematization of knowledge construction, dissemination, and deployment became crucial with the emergence of formal education, at first for ancient philosophers and astronomers to form disciples who could sustain and carry forward their vision of the world and for craftsmen and other professionals to form apprentices who could make their crafts, trades, and services thrive in society. It became most crucial when enlightened rulers and decision-makers wanted formal education to become an institutionalized, widespread endeavor to transfer knowledge accrued throughout generations to youngsters at large so that they may take advantage of it for their own welfare and the welfare of their communities and humankind.

Human knowledge has already so much proliferated and diversified in constituents, organizational modes, and procedural modalities, and it continues to do so at a fast and unprecedented pace that no individual or community can keep up with. This is true for knowledge about the physical world, including humankind and all organisms and species we are part of, all products, processes, and services we have invented, as well as for knowledge about the abstract realm of our own imagination, like in the case of music and mathematics.

Systematization of learning how to learn in general, and of learning about professional knowledge in any community of practice, academia included, becomes then far more crucial than ever before in formal and informal education. *Systemism*, as introduced in Chap. 1 and elaborated throughout this book, is a worldview and a mindset that can serve us best in this respect in cognition and various aspects of formal education.

With a systemic worldview, we conceive everything within us and around us as consisting of interacting physical or conceptual systems or parts of systems (or of subsystems). Simply put, a system is an ordered unit or totality consisting of interconnected and interdependent physical or conceptual entities that come together or that are brought together in order to serve specific purposes under specific conditions. With a systemic mindset, we learn about, interact with, and modify both the physical world and the abstract realm through appropriate conceptual systems that we construct to represent and investigate patterns of interest in either world or realm and/or to make changes in these patterns or bring about new patterns altogether.

Systemism is of great value to experts working in a given discipline and to students learning about that discipline. Looking at any discipline in any field with systemic conceptual lenses (e.g., the disciplines of physics and biology in the field of natural sciences, algebra and geometry in mathematics, music and painting in arts, philosophy and literature in humanities) brings for experts and students alike coherence and consistency to content and process (or declarative and procedural) knowledge in that discipline, and efficiently systematizes knowledge construction and deployment. More importantly, systemism efficiently systematizes disciplinary convergence, i.e., bringing and connecting together different disciplines in the same and different fields in order to tackle issues that neither discipline helps tackling well enough independently of other disciplines.

Such convergence is behind major inventions and disciplinary advances we have witnessed in the last few decades, and it is, and will continue to be, at the very foundations of most new careers and all other developments affecting our lives that have emerged and that will keep emerging in the twenty-first century. These developments have necessitated major paradigmatic changes in numerous professions, changes that have been quite revolutionary in some instances like in the case of digital technology. Meanwhile, paradigms that go back to the nineteenth century, and that the developments in question have turned obsolete in many respects, continue to prevail in all aspects of formal education at all educational levels, and in many parts of the world, from pedagogy and curricula to structure and governance of educational institutions and of entire educational systems. Alternative paradigms of systemic nature help education resonate well with both human cognition and the changing realities of the century in the workplace and elsewhere in daily life.

Each community of practice (CoP) or professional community is characterized with a particular paradigm that governs how the community goes about developing its content and process knowledge and deploying it in tackling issues of concern to that community. In academia, a CoP is usually concerned with one distinctive discipline, and disciplines in the same field may share one or more common paradigms. For example, in natural sciences, two paradigms prevail across the board, the so-called classical and modern paradigms that are adapted in specific respects to the particular needs of every discipline.

Scientific paradigms are systemic par excellence, though implicitly for most scientists, because science is primarily concerned with the description, explanation, and extrapolation of patterns in the structure and behavior of physical systems. CoPs

concerned with non-scientific fields can similarly conceive and deploy their disciplinary knowledge in the framework of systemic paradigms for better systematization within and across disciplines and fields, particularly for convergence purposes, and most importantly for pedagogical purposes.

The prime function or mission of formal education is about helping students develop appropriate profiles for self-fulfillment, success in life, and significant contributions to the welfare of others and the ecosystem. That mission is best fulfilled when students are empowered with systemic profiles as discussed in Chap. 2. At the core of a systemic profile are habits of looking at the world and dealing with it with systemic worldview and mindset. These habits evolve from gradual development of systemic competencies needed to tackle certain tasks that may fall within the scope of a particular discipline or cut across different disciplines. A systemic competency consists of an appropriate mix of conceptions (concepts and relations among concepts), reasoning skills, sensorimotor skills, and axio-affective controls (in particular, a good value system and constructive attitudes and dispositions) that are necessary to successfully achieve similar tasks with a systemic mindset.

Systemic profiles are further distinguished with particular traits that turn them into what we call *4P profiles*. A person with a systemic 4P profile is characterized with a *progressive* mind that seeks to develop and constantly enhance *productive* habits for systematizing and optimizing the person quest for, and deployment of, *profound* knowledge that concentrates on substantial and generic conceptions and processes in any domain, all with a commitment to *principled* conduct in all aspects of life.

Learning involves cognition and is most meaningful and productive when experiential, i.e., when it takes place through transaction with real-world situations and other people, teacher and peers included. Cognition, as discussed in Chap. 3, is about memory development that takes place to adapt to new demands through conscious and unconscious mind and brain processes induced or not by external signals detected by our senses. Cognitive outcomes affect how we think, perceive people and things, feel and act in the future, and thus determine the course and outcomes of prospective learning experiences.

Memory development begins with encoding new knowledge in working and short-term memory and then follows with gradual reinforcement of the new knowledge for integration with existing memory patterns and consolidation or permanent sustainability in the long-term memory. Newly encoded memory is consolidated only after successive retrieval for rehearsal in a variety of situations that continuously impose new but reasonable cognitive demands and that engage a mix of brain regions of distinct functions regarding knowledge construction and deployment. All memory processes from encoding to consolidation are modulated by particular brain regions concerned with attention, motivation, emotions, and other metacognitive factors that control how learning proceeds and determine the quality of outcomes it brings about.

Pedagogy is about systematizing how students learn and about optimizing learning conditions and outcomes. As discussed in Chap. 4, pedagogy is most effective when systemic, i.e., when it conforms to human cognition and when it helps students develop systemic 4P profiles in systemic learning ecologies. In the first respect, systemic pedagogy helps students explicitly learn how to learn through conscious

and systematic encoding, deployment (retrieval and rehearsal in novel contexts), and consolidation of generic content and process knowledge. Special attention is then given to systemic knowledge organization and pattern-focused systemic processes for knowledge construction and deployment. In the second respect, systemic pedagogy engages students individually and collectively in experiential, hands-on, minds-on, learning activities pertaining to real-life situations and carried out insightfully in structured but flexible learning cycles with proper teacher mediation. Insightful experiential learning involves continuous evaluation and regulation of student knowledge throughout every learning exercise, and particularly through assessment that is not an end by itself, but means for a worthy end: meaningful learning of course materials and development of systemic 4P profiles for success, even excellence in life.

The latter end is the ultimate goal of systemic education that transcends traditional education in practically every respect as discussed in Chap. 5, from curriculum design and implementation, teacher training and working conditions, to governance of educational institutions and entire educational systems. In systemic formal education, teachers teach not to the test and not to inform students about specific disciplinary knowledge as passed along from one generation to another in traditional textbooks. Instead, teachers insightfully implement systemic curricula that they helped developing under mind and brain-based pedagogical frameworks and that they keep regulating to meet their students' needs and prepare them to cope with the changing realities of the twenty-first century.

Any discipline is organized in any curriculum at any level around a limited set of powerful conceptual systems and systemic processes that meet students' cognitive potentials at a given age and preserve and reveal, to the extent that is possible, the paradigmatic rigor of the discipline. As such, systemic curricula allow systematization of learning in the context of individual disciplines and across different disciplines to the extent of realizing what we call differential convergence education, which is about bringing together knowledge from different disciplines, while preserving the integrity and sovereignty of each discipline, in order to tackle real-life issues.

Differential convergence education may take place, for a start, in the context of traditional disciplinary curricula, and is optimized through experiential learning that culminates in suitable educational modalities of praxis. Students would then be immersed into praxis, beginning at least at the secondary school level, in order to learn how to bring theory and practice systemically and systematically together like professionals do in given CoPs, and how to tackle issues students are themselves interested in, using actual CoP conceptual and physical tools, modern technology included. Under propitious conditions, traditional disciplinary education would then be transcended into systemic, praxis-immersive, convergence education (SPICE) that ultimately forms graduates who know how to think outside the box and excel in practical real-life situations in the most innovative ways possible.

SPICE, like any other form of education that meets the realities of the century, requires across the board transcendence of traditional education, including the way educational institutions and entire educational systems are structured and operated. In particular, rigid top-down authoritative governance should be given away in favor

of truly systemic governance that allows all organisms and stakeholders in an educational system to readily and autonomously adapt to any change within and outside the system and constantly operate with a hive-mind spirit and shared responsibility. Systemic governance should also provide for educational institutions and all other organisms in the system to work in close partnership with each other and with all sectors of society, particularly for SPICE sake. For, these sectors are most concerned with the specification and realization of student profiles that are necessary to succeed and excel in respective careers and operations. For optimal systemic education, and for students' excellence in various aspects of life to become an ultimate part of the mission of formal education, educational systems and various sectors of society need to work systemically and systematically together on engraining a culture of excellence throughout society.

Systemic Cognition and Education (SCE) brings together philosophy, cognition and psychology grounded in neuroscience, and reliable educational theory and research to provide substantiated pedagogical premises for learning and instruction, and sustain premises and ensuing practice with viable paradigmatic foundations for the entire educational enterprise. SCE is about what it takes for education to resonate well with the way the world within us and around us is and works in order to bring about graduates who are empowered to excel in various aspects of life and not conditioned to pass school and high-stakes exams.

SCE relies on systemism to provide a seamless paradigmatic perspective on education. According to systemism, we can best conceive and deal with the world within us and around us when we look at ourselves as biological and cognitive systems that constantly affect and are affected by local and global environments made of different sorts of systems. SCE calls then for education to transcend all traditional paradigms and settings, for systemism for excellence to prevail instead throughout educational systems, from pedagogy to governance and from curricula to institutional organization, and for achieving and sustaining the systemic transcendence in partnership with various sectors of society, ultimately in the direction of systemic, praxis-immersive, convergence education (SPICE).

Jounieh, Lebanon

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About the Author



Ibrahim A. Halloun is recognized worldwide for his seminal contributions to education. He is particularly known for his work on students' intuitive ideas about the physical world and their novice views about knowing and learning science, and for turning scientific models and modeling into pedagogical tools and methodology for experiential, meaningful learning of physics and other STEM disciplines at the secondary school and university levels.

Prof. Halloun has contributed to curriculum reform in many countries around the globe and was behind several initiatives for systemic reform. He has been focused lately on systematizing the entire educational enterprise under systemic paradigms that meet the realities of the twenty-first century and that empower students to think outside the box and excel in various aspects of life. Systemic, praxis-immersive, convergence education (SPICE) is at the core of his attention, especially cross- and trans-disciplinarity that efficiently bridge traditional divides among disciplines from different fields like arts and science that are often misconceived as remotely related to each other.

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